



TASK OFFLOADING FRAMEWORK TO ENHANCE ENERGY EFFICIENCY OF SMARTPHONES

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ABSTRACT

Although the evolution and enhancements that mobile devices have experienced, they are still considered as limited computing devices. Cloud is a promising strategy to enhance the computing capability of today's smart phones and to increase the battery life. Communication cost of task offloading of mobile devices is much more expensive than the one that is used in desktop devices. Challenges in consumption of the communication activity can be reduced by making an exact decision while performing the activity of task offloading. 3G and 4G devices are taking into consideration to develop an energy efficient model for task offloading. Task offloading has a great advantage over traditional endoscopy because it is possible and easy to use. We use five smart phones to conduct the experiment. The experimental results show that our estimation models precisely estimate the energy essential to offload tasks.

KEY WORDS: Mobile Computing, Cloud Computing, Smart phones, Offloading Decision, Energy Saving, WLAN Energy, 3G Energy, 4G Energy, Energy Estimation.

INTRODUCTION:

Battery energy, processing capability, and memory capacity are the some of the exclusive constraints of smartphones. In the most recent couple of years, quick advances in semiconductor innovations have lightened some of those requirements. The restricted battery liveliness requirement has not been acceptably tended to. As indicated by Moore's law, The rate of transistors on an integrated circuit is rapidly increased every two years. It is not acceptable the limitation of battery energy. As compared to transistor growth in every year only 5% of growth expected in battery capacity. To reduce the battery consumption we need to focus on the task implementation of the smartphones. Battery problem becomes one of the critical issues among the smartphone users. Today's smartphone is able to do run all application that has been work on the desktop computer. Some of the examples of the operating system are Blackberry, Apple iOS, Android and much more. The only way to reduce battery consumption is to offload the series of tasks over the cloud platform.

MATERIALS AND METHODS:

Technologies Used:

During the solution development, following hard-wares were used:

- 250 GB HD
- 4GB RAM
- Cloud Environment
- Wireless Router
- 3G and 4G Smartphones.

Software Requirement:

- JAVA
- Android
- Cloud Environment
- Bootstrap

Results:

The battery drainage will be measured to compare it with the other scenario. The initial segment occurs once the consumer initiate to transfer the large amount knowledge as possible, that causes variations in the power consumption. In the second segment starts once a consumer of the database fires a query on a database which is in the cloud then all the complex computation will perform on the cloud. Finally, both the scenarios offload the heavy task to the cloud then it will save 30% to 70% of the energy of smartphone.

The energy cost equation:

$$\text{Consumption of Energy} = \frac{\text{Battery Consume}}{\text{Total Battery}} + \frac{\text{Memory Consume}}{\text{Total Memory}}$$

The following table shows the Energy consumption by 3G and 4G

Table 1: Old smartphones of Energy consumption by 3G and WiFi

| Application | 3G | WiFi |
|-------------|---------|---------|
| HQ Stream | 708.7mW | 604.0mW |
| LQ Stream | 753.0mW | 367.7mW |
| Download | 204.5mW | 163.9mW |
| Browsing | 327.5mW | 139.5mW |

Table 2: Old smartphones of Energy consumption by 3G, 4G and WiFi

| Network | Activity | Smartphone | | | |
|---------|----------|------------|-----|------|------|
| | | UE1 | UE2 | UE3 | UE4 |
| WLAN | Download | 485 | 580 | 670 | 1010 |
| | Upload | 830 | 780 | 850 | 1140 |
| 3G | Download | 730 | 700 | 1080 | 950 |
| | Upload | 750 | 711 | 1125 | 1025 |
| 4G | Download | NA | NA | 1100 | 965 |
| | Upload | NA | NA | 1130 | 1220 |

DISCUSSION:

The proposed framework is evaluating by measuring the prototype application for Android devices in the real cloud computing framework environment for mobile. The server is designed and configured for the services to the mobile device in the online mode. Various power tutor tools used for the measuring the performance of battery power consumption in distributed application processing. SaaS model of computational clouds is used for the provision of services to mobile devices.

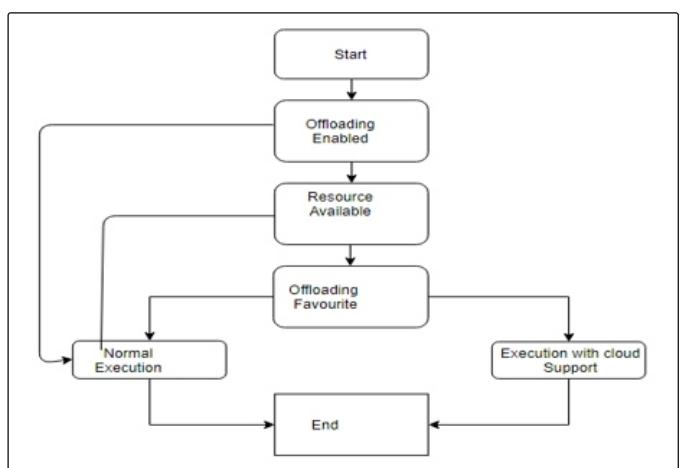


Fig.1: Flowchart for Mobile Cloud Offloading

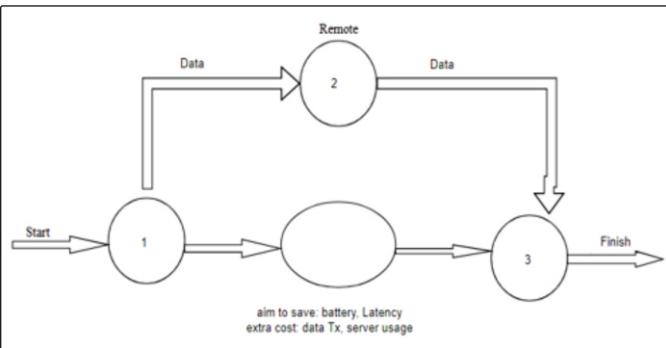


Fig.2: Three Task of Mobile Task Offloading

An application consists of three tasks. While offloading task 2 to the remote server aims to save mobile energy consumption and shorten the total delay transmission induces extra cost in both energy and delay metrics, and cost for cloud computing.

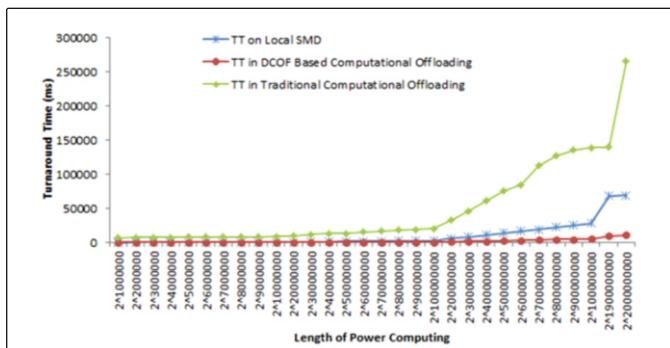


Fig.3: Turnaround Time of Power Compute Operation in Local Execution and Remote Execution

CONCLUSION:

Expanding the capabilities of smartphones is conceivable by undertaking offloading to the cloud. Task offloading is critical to making offloading beneficial. Task offloading is only beneficial when the energy required to offloading is less than energy consumed without it. To do so, the most important challenge in Task offloading is to calculate accurately the consumed energy during activities of the network. The mathematical model has been developed to find out the exact consumption of energy. To calculate the details of energy consumption of network we examine the network from the lower layer to higher layers. Thus offloading the task from smartphone to the cloud is an emerging strategy to improve and utilize the computing capability of the smartphone in more efficient way and prolong their battery life.

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